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FURTHER OBSERVATIONS ON THE DISPOSAL OF EXCRETA (SECOND PAPER).[a]

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THE SURFACE PRIVY.

(1) If night soil containing live fly larvæ[b] is taken from a surface privy and buried in 6½ inches of sterilized sand, the burial of the material does not insure the death of the insects; on the contrary, the latter are able to penetrate the sand and to issue as adult flies. This observation (experiment 15) emphasizes the point that all fecal material should be rendered harmless and it raises still further misgivings in regard to the popular faith in the dry system. Unless a dry privy is rigidly fly proof, exposed or partially exposed feces give flies an opportunity to oviposit and as the resulting fly larvæ are not killed by shallow burial, so often practiced, the possibility of the dissemination of filth and disease germs still remains.

(2) Burial in 6½ inches of sand does not prevent hookworm (*Necator americanus*) larvæ from coming to the surface (experiment 15).

CARBOLIC METHOD.

(3) When feces containing hookworm eggs were placed in a 2 per cent mixture of crude carbolic acid with water live hookworm eggs were found after 24 hours, but live eggs were not found on date of next observation, twenty-third day (experiments 14, 14*b*, 14*c*). The carbolic mixture in question killed hookworm embryos and larvæ in a few moments under the microscope, so that the indications are that this method would be a safe one so far as hookworm disease is concerned. It is also safe so far as flies are concerned, as fly larvæ died promptly and flies did not oviposit or feed on the floating fecal material. Despite the advantages, we warn against its possible dangers, and on account of such dangers we do not recommend it.

[a] See Public Health Reports, vol. 24 (27), 1910, July 8, pp. 947–950.

[b] Mr. Coquilett has kindly determined the flies as *Ophyra leucostoma* Wild.

WATER METHOD.

(4) If a pail system is used, and only water placed in the bucket, the development of hookworm (*Necator americanus*) eggs is inhibited and some of the eggs die; live eggs may, however, be found even at the end of 24 days. Further, mosquitoes will oviposit in the water, despite its character, and live mosquito larvæ[a] may be found (experiment 17). This indicates that some safeguarding material must be added to the water.

WATER AND KEROSENE METHOD.

Feces containing eggs of *Ascaris lumbricoides* and *Necator americanus* were taken from surface privies and placed in jars of water with a film of kerosene.

(5) As the fecal material breaks up some of the eggs float to or near the surface of the water (experiment 13). This observation strongly indicates the necessity of examining for eggs of parasites the material used on sewer fields.

(6) Even 2 inches of water, with a film of kerosene, is exceedingly inhibitory to the development of the eggs, both of *Ascaris lumbricoides* and *Necator americanus* (experiment 5).

(7) Under about 9 inches of water, with a film of kerosene, hookworm eggs begin to die after 4 days; live eggs were found on the fifth, seventh, ninth, twenty-eighth, twenty-ninth, and thirty-third days, but no egg was found which had developed to the "tadpole" stage. On the twenty-eighth day 65 per cent of 20 eggs examined, on the twenty-ninth day 90 per cent of 20 eggs examined, and on the thirty-third day 75 per cent of 20 eggs examined were dead (experiment 4).

(8) Thus, if the water and kerosene method is used, it is unsafe (from the standpoint of hookworm disease) to throw the excreta on the ground, even if they have fermented for 33 days (experiment 4).

(9) The water and kerosene method reduces the odor almost to a negligible degree.

(10) If water and kerosene are added to a pail containing fly-blown feces, some of the fly larvæ succeed in crawling through the oil and escaping from the pail.

(11) But if the water and kerosene are placed in the tub before use, or before the feces become fly-blown, the feeding and breeding of flies, mosquitoes, and other insects in the night soil seem to be eliminated, and thus the danger of the spread of filth and bacterial infection from the privy tub to the food, by means of insects, appears to be excluded, unless, of course, the tub is permitted to become so full that it runs over and unless it is filled with paper to a degree that the feces are not affected by the water and oil.

(12) Thus far the chief objections we have been able to develop to the water-kerosene method are:

(*a*) If the water is too deep, splashing occurs; plans to prevent this splashing are now under experiment.

[a] Kindly determined by Mr. Knab as probably belonging to *Culex quinquefasciatus* Say.

(*b*) A tendency to economize may result in the use of too small a receptacle; a wet system clearly calls for a larger receptacle than a dry system.

(13) The question naturally arises whether it would be feasible to apply the water-kerosene method to manure piles, in order further to prevent the breeding of flies.

(14) Newspaper is not disintegrated at the end of 33 days.

THE PRESENT STATUS OF THE PRIVY PROBLEM.

The privy is the great sanitary problem of the open country and the nonsewered villages. As it is not known which persons in a given community are carriers of typhoid, amœbæ, hookworms, Cochin-China diarrhea, *Ascaris*, etc., it is necessary from the public health point of view to impress upon the public the thought that all fresh human feces should be accepted as dangerous and should be treated as if they were actually a virulent poison. To adopt any other course is to run a risk of unnecessary sickness and death, especially among children. To bury the night soil without first safeguarding it may result in disease; to permit a continuation of the use of fresh night soil as fertilizer, in view of present day knowledge, is to permit a custom endangering life. Burning or boiling the human excreta is at present the most ideal plan, but while feasible in many instances it is not of universal feasibility. Still, we must not close our eyes to the fact that in the present absence of definite knowledge regarding the viability of certain infections (as amœbæ, for instance), every other plan (disinfectants included) must for the present be accepted as a compromise.

The best known compromise (the sewer) is not applicable to the open country; even as this system is used (and abused) in cities, we should recall that our knowledge regarding the possible distribution of zooparasitic diseases by the sewer system is very rudimentary. The surface privy is a distinct improvement over none at all, but is unwarranted in view of present-day knowledge. The so-called "pail system" (including any water-tight receptacle, as a can, tub, or barrel) is the least that can possibly be demanded. Some safeguarding material should be used in this pail. If dry earth, ashes, or lime is used, the entire privy should be made rigidly fly proof; if a fluid system is used, the screening is not quite as necessary, and thus a less expensive privy can be built. It remains to find a system of safeguarding which will be practical as well as theoretically not too inefficient. All systems have their advantages and their disadvantages; none is perfect.

The great practical disadvantage of the "dry" systems is that they call for cooperation from persons (children and many adult persons) whose cooperation can not be relied upon; given the lack of cooperation, even in a relatively small percentage of the population, and the advantages of the system are far less than popularly supposed, for flies and worms can develop and come to the surface, and thus continue to spread infection. If the dry system is adopted, the night soil should be subjected to heat in order to kill infection. The great practical advantage of the "dry" system lies in the fact that so many people already know about it. It is a great advance over the surface privy.

In dealing with rural localities and many towns, one of the greatest obstacles to be considered is the widespread desire to use the night soil as fertilizer. Whatever our views on this subject may be, we must face the fact that it is a deeply rooted custom among our people which it may take a generation to eradicate. One great advantage of the "wet" system is that it seems to offer a promise that a means may be found whereby we may still retain whatever value there may be in night soil as fertilizer and at the same time do away with the risk involved in this custom. Thus, making an economic concession to farmers, we may still avoid the risk of estranging a large number of them from necessary sanitary improvements. To make it economically worth while to be sanitary in one's habits is one of the keynotes of sanitary advance.

An advantage of the water-kerosene method is that it can be installed with so little trouble and with so little change in the present privies. The only really necessary additions to the present surface privy are a platform under the seat, a receptacle such as a tub or barrel, under the seat, and the necessary barrels for fermentation, or an iron pail for boiling.

Further studies on this system are still necessary (especially in connection with the splashing and the minimum time for fermentation), but it seems to promise more at less trouble and less expense than does the "dry" system, and it has the great advantage that it requires cooperation of a much smaller proportion of the population.